

Non-Linear Non Stationary Analysis of Two-Dimensional Time-Series Applied to GRACE Data, Phase II

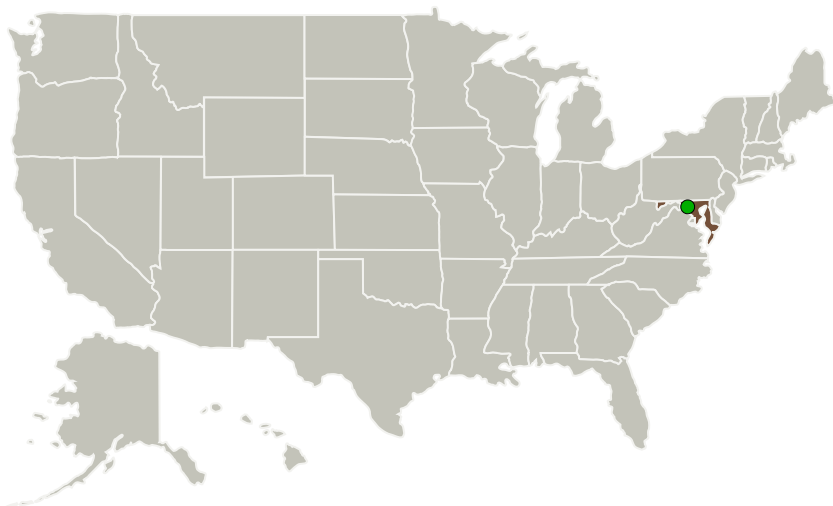
Completed Technology Project (2011 - 2013)



Project Introduction

The proposed innovative two-dimensional (2D) empirical mode decomposition (EMD) analysis was applied to NASA's Gravity Recovery and Climate Experiment (GRACE) mission database in phase I in an attempt of extracting and revealing the finest details of regional and seasonal variations. The proposed innovation is a robust and adaptive data analysis method based on a 2D adaptive isotropic decomposition approach primarily for the GRACE orbital data. The phase-I effort included a research component to optimize the prototype 2D analysis developed by Starodub. Early results using the prototype algorithms have demonstrated great potential of extracting physical cyclic components in equidistant sinusoidal grids of variations of surface density generated using spherical harmonics coefficients of GRACE. The modes associated to noise and trends were estimated and removed adaptively in 2D. In phase II, The solutions for selected NASA applications in earth sciences, space exploration, and astrophysics will be defined both at the global and regional levels: For example, the regions of Greenland, the Gulf of Alaska glacier, and Antarctica will be studied for the GRACE application. The technical development will include the following areas: detection, de-noising, spectral analysis, reconstruction, and registration, and comparison of result with principal component analysis. The anticipated increases in data resolution and understanding of sources of signal noise in gravity field combined to satellite or airborne laser/radar altimetry will benefit the estimation of the Earth's gravimetry, cryosphere, hydrosphere, and ocean science.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Starodub, Inc.	Lead Organization	Industry	Kensington, Maryland
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Maryland

Project Transitions

**June 2011:** Project Start**May 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139172>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Starodub, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Nicolas Gagarin

Co-Investigator:

Nicolas Gagarin

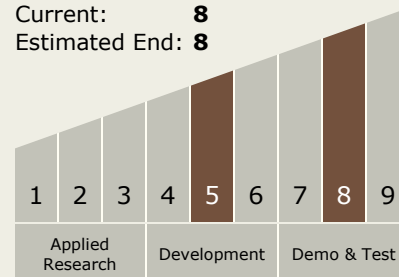
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Technology Maturity (TRL)

Start: 5
Current: 8
Estimated End: 8



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
 - └ TX11.4 Information Processing
 - └ TX11.4.4 Collaborative Science and Engineering

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System